Early Journal Content on JSTOR, Free to Anyone in the World

This article is one of nearly 500,000 scholarly works digitized and made freely available to everyone in the world by JSTOR.

Known as the Early Journal Content, this set of works include research articles, news, letters, and other writings published in more than 200 of the oldest leading academic journals. The works date from the mid-seventeenth to the early twentieth centuries.

We encourage people to read and share the Early Journal Content openly and to tell others that this resource exists. People may post this content online or redistribute in any way for non-commercial purposes.

Read more about Early Journal Content at http://about.jstor.org/participate-jstor/individuals/early-journal-content.

JSTOR is a digital library of academic journals, books, and primary source objects. JSTOR helps people discover, use, and build upon a wide range of content through a powerful research and teaching platform, and preserves this content for future generations. JSTOR is part of ITHAKA, a not-for-profit organization that also includes Ithaka S+R and Portico. For more information about JSTOR, please contact support@jstor.org.

VALLEYS OF SOLUTION IN NORTHERN ARKANSAS

PROFESSOR G. F. MARBUT has called attention to valleys of solution in Missouri.[1] Before this had come to the present writer's notice, he had become convinced that a type of valley which occurs in large numbers in the Boone chert of Arkansas owes its existence to the differential solution of the rock.

The Boone chert lies at the base of the Mississippian series in Arkansas. Over a large part of the region north of the Boston Mountains, erosion has left this as the surface rock. It approximates 400 feet in thickness and is essentially an immense deposit of limestone containing chert which varies greatly in amount, both horizontally and vertically.[2]

In all places where the Boone chert is the surface rock, the calcareous portion has been partly removed by solution, leaving a residue of chert, in places several inches deep, on the surface. The universal distribution of the small chert particles over the surface reduces the run-off to the minimum and increases the underground water to the maximum. As a consequence, valleys of solution are numerous throughout the region in which this is the surface rock. So different are these valleys from those of corrasion that they attract the attention of even the untrained observer. While seldom of great length, their length is always great in proportion to the width, and the latter is strikingly uniform throughout. To borrow a term from biology, they are always bilaterally symmetrical, and their slopes are steep (Fig. 1). They are remarkably straight, seldom deviating from a straight line more than a few feet except at the points where two valleys unite (Fig. 2). Probably the most striking feature about them is that they head suddenly, the heads often having exactly the appearance of half a sink-hole cut with a vertical plane through the center. Not infrequently the heads are forked, as shown in Fig. 1. The bottoms and slopes are covered with angular residual chert, leaves and branches of trees (Fig. 1). If surface water ever flows through the upper parts of these valleys, it is only after excessive rainfalls. Extended travel over the region has not yet brought to the writer's notice a single case in which the upper part of one of these valleys has been occupied by surface water in sufficient quantity to remove the residual chert.

---

[1] Missouri Geological Survey, Vol. X, pp. 88–92.

[2] For a full description of the Boone chert, see Rep. of the Ark. Geol. Surv., 1890, Vol. IV., pp. 94–107.

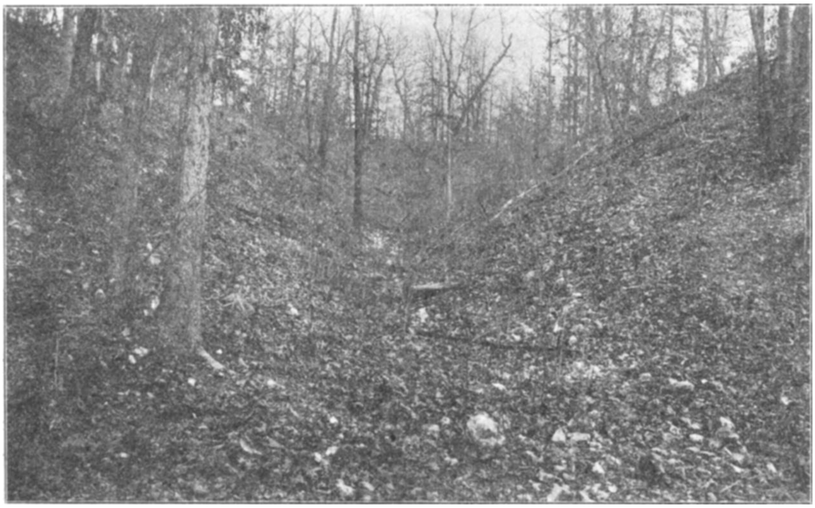

FIG. 1.

Unlike the valleys which Professor Marbut describes in Missouri, these valleys are narrow and steep-sloped in their upper parts and pass into rather wide, open valleys which owe their forms to both solution and corrasion. The topographic transition from that part of the valley that is due wholly to solution to the part that is due to both solution and corrasion is of course gradual. The point, as the writer conceives it, where the one passes into the other is determined by the groundwater level. Above the point where the valley cuts into the groundwater, the work is done by solution; below that point a surface stream exists which adds the work of corrasion to that of solution, the latter occurring mainly on the valley slopes above the stream bed. As this work goes on and the stream bed continues to be reduced more and more below the average level of groundwater, the stream grows in size, and in time, by meandering, is able to produce a wide valley.

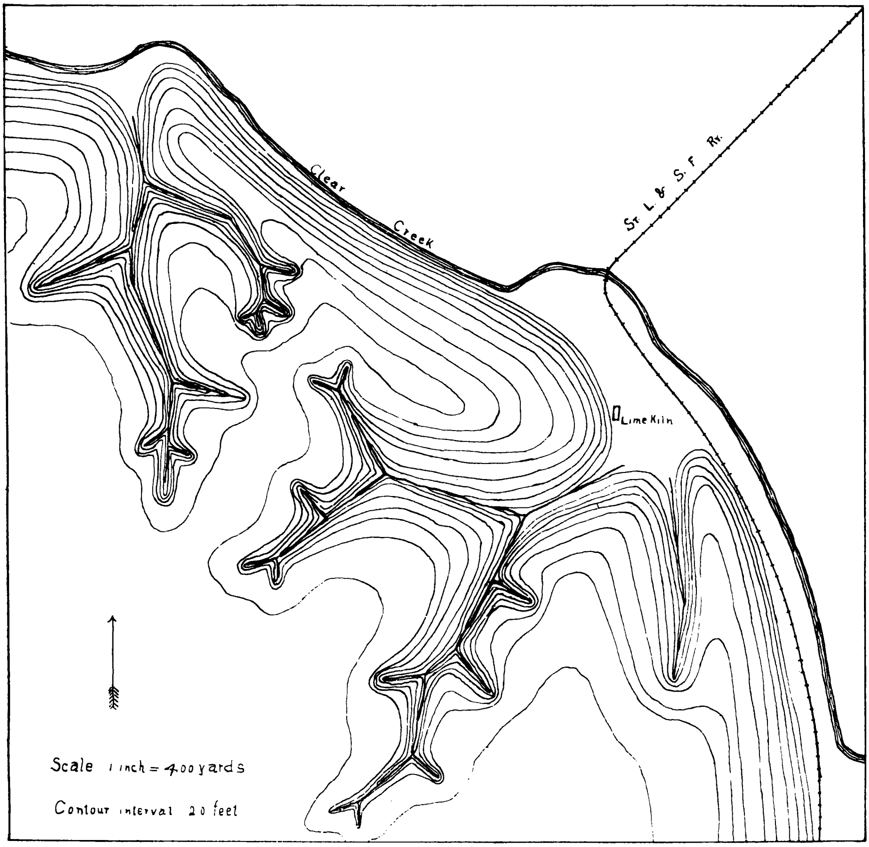

FIG. 2.

The point at which the valley cuts into groundwater of course varies with the seasons, but on the whole it is moving up the valley because of the differential solution brought about by the large amount of groundwater moving down the slope from either side and meeting beneath the bed of the valley.

Fig. 2 is a map of two of these valleys with their tributaries, four and a half miles north of Fayetteville. The map was made with a plane-table without correction for magnetic variation. These are typical of valleys that occur in the Boone chert of Arkansas by the thousand. The heavy lines are placed along the bottoms of the valleys only to bring to notice the angles at which they join each other. These angles vary from 60 to 100 degrees or more, the most common one being 80 degrees. It will be noticed that the angles at which the main valleys and their tributaries unite are quite different from those of corrasion.

The writer thinks there can be no doubt but these valleys are determined by the jointing of the horizontal beds of rocks. The double heads which are so common among them are tributary valleys in their incipiency, following joints which intersect along the course of the main valley.

The large valleys which contain the master streams of the Boone chert region were probably inherited, with their streams, from the former superimposed rocks, but the valleys here mentioned owe their origin and development to solution, aided possibly by the removal of part of the residual chert after the most excessive rains.

A. H. PURDUE.

UNIVERSITY OF ARKANSAS,
Fayetteville, Arkansas.